CZ3006 Lab 4

Aim: Doing basic analysis of data log

In [1]:
```
# Basic Libraries
import numpy as np
import pandas as pd
```

Creating the dataframe using pandas library

1. list the column names required
2. import the csv adding in the column names

In [2]:
```
colName = ['Type', 'sflow_agent_address', 'inputPort', 'outputPort', 'src_Mac', 'dst
SFlow = pd.read_csv('./SFlow_Data_lab4.csv', header = None, names=colName, index_col
SFlow.head()
```

Out[2]:

	Type	sflow_agent_address	inputPort	outputPort	src_Mac	dst_Mac	ethernet_type	i
0	FLOW	aa.aa.aa.aa	137	200	d404ff55fd4d	80711fc76001	0x0800	
1	FLOW	aa.aa.aa.aa	129	193	609c9f851b00	0031466b23cf	0x0800	
2	FLOW	aa.aa.aa.aa	137	200	d404ff55fd4d	80711fc76001	0x0800	
3	FLOW	aa.aa.aa.aa	129	135	609c9f851b00	002688cd5fc7	0x0800	
4	FLOW	aa.aa.aa.aa	130	199	00239cd087c1	544b8cf9a7df	0x0800	

EXERCISE 4A: TOP TALKERS AND LISTENERS

One of the most commonly used function in analyzing data log is finding out the IP address of the hosts that send out large amount of packet and hosts that receive large number of packets, usually know as TOP TALKERS and LISTENERS. Based on the IP address we can obtained the organization who owns the IP address.

The organizations are found using the link https://whatismyipaddress.com/

In [3]:
```
#aim is to find the top 5 talkers using IP address
table1 = SFlow.loc[SFlow['Type'] == 'FLOW']
table1 = pd.DataFrame(table1['src_ip'])
Top5Talkers = table1.value_counts()
Top5Talkers.head()
```

Out[3]:
```
src_ip
193.62.192.8      3041
155.69.160.32     2975
130.14.250.11     2604
14.139.196.58     2452
140.112.8.139     2056
dtype: int64
```

In [4]:
```
#aim is to find the top 5 listeners using IP address
table1 = SFlow.loc[SFlow['Type'] == 'FLOW']
table1 = pd.DataFrame(table1['dst_ip'])
Top5Listeners= table1.value_counts()
Top5Listeners.head()
```

```
dst_ip
```

Out[4]:
```
103.37.198.100     3841
137.132.228.15     3715
202.21.159.244     2446
192.101.107.153    2368
103.21.126.2       2056
dtype: int64
```

EXERCISE 4B: TRANSPORT PROTOCOL

Using the IP protocol type attribute, determine the percentage of TCP and UDP protocol

In [5]:
```
table1 = pd.DataFrame(SFlow['IP_protocol']) #take out IP_protocol only
IPprotocol = table1.value_counts() #count the number of unique occurrences
IPprotocol = IPprotocol.to_frame().reset_index() #reset the index
IPprotocol.columns = ["IP_Protocol", "packets"] #rename the column
print(IPprotocol) #print the table
totalpackets = IPprotocol['packets'].sum()
print()
# printing all the statistics
print("Total number of packets sent : ", totalpackets)
print("Percentage of UDP", 10*" ", ": ", np.array(IPprotocol.loc[IPprotocol['IP_Prot
print("Percentage of TCP", 10*" ", ": ", np.array(IPprotocol.loc[IPprotocol['IP_Prot
```

```
   IP_Protocol  packets
0            6    56064
1           17     9462
2           50     1698
3            0     1261
4           47      657
5           41      104
6            1       74
7          381       45
8           58        4
9          103        1

Total number of packets sent :  69370
Percentage of UDP            :  13.639901974917112
Percentage of TCP            :  80.81879775118928
```

EXERCISE 4C: APPLICATIONS PROTOCOL

Using the Destination IP port number determine the most frequently used application protocol. (For finding the service given the port number https://www.adminsub.net/tcp-udp-port-finder/)

In [6]:
```
table1 = pd.DataFrame(SFlow['udp_dst_port/tcp_dst_port'])
Top5Apps = table1.value_counts()
Top5Apps = Top5Apps.to_frame().reset_index()
Top5Apps.columns = ["udp_dst_port/tcp_dst_port", "packets"]
print(Top5Apps.head(5))
totalpackets = Top5Apps['packets'].sum()
print()
print("Total number of packets sent : ", totalpackets)
```

```
   udp_dst_port/tcp_dst_port  packets
0                        443    13423
1                         80     2647
2                      52866     2068
3                      45512     1356
4                      56152     1341

Total number of packets sent :  69370
```

EXERCISE 4D: TRAFFIC

The traffic intensity is an important parameter that a network engineer needs to monitor closely to determine if there is congestion. You would use the IP packet size to calculate the estimated total traffic over the monitored period of 15 seconds. (Assume the sampling rate is 1 in 2048)

IP packet size corresponds to the IP_Size column name

In [7]:
```
table1 = pd.DataFrame(SFlow['IP_Size'])
totalbytes = table1.sum()
totalMB = totalbytes / 1000 /1000 * 2048
print("Total Traffic (MB) : ", np.array(totalMB)[0])
```

```
Total Traffic (MB) :  132664.979456
```

EXERCISE 4E: ADDITIONAL ANALYSIS

Please append ONE page to provide additional analysis of the data and the insight it provides. Examples include: Top 5 communication pairs; Visualization of communications between different IP hosts; etc. Please limit your results within one page (and any additional results that fall beyond one page limit will not be assessed).

Finding the top 5 communication pair

We have to take into account the fact that src --> dst and dst --> src both have to be counted as a communication pair. For example, two such entries:

src | dst 137.132.228.15 193.62.192.8
193.62.192.8 137.132.228.15

means between the IP addresses `137.132.228.15` and `193.62.192.8` there have been **2** communications.

In [8]:
```
#make this neater
table1 = pd.DataFrame(SFlow[['src_ip', 'dst_ip']])
table2 = pd.DataFrame(SFlow[['src_ip', 'dst_ip']])
table1.rename(columns = {'dst_ip': 'IP1', 'src_ip': 'IP2'}, inplace = True)
table2.rename(columns = {'dst_ip': 'IP2', 'src_ip': 'IP1'}, inplace = True)
finaltable = pd.concat([table1, table2])
commpair = (finaltable.groupby(['IP1', 'IP2'])).size().sort_values(ascending=False).
commpair['index'] = commpair.index
df_1 = commpair[['IP1', 'index', 'count']]
df_2 = commpair[['IP2', 'index', 'count']]
df_1.columns = ['IP', 'index', 'count']
df_2.columns = ['IP', 'index', 'count']
df_1['source'] = 1
df_2['source'] = 2
df = pd.concat([df_1, df_2])
out = df.sort_values(['index']).drop_duplicates(['IP'], keep='first')
df_1_out = out[out['source'] == 1][['IP', 'count', 'index']]
df_2_out = out[out['source'] == 2][['IP', 'count', 'index']]
final = df_1_out.merge(df_2_out, on='index', suffixes=('_1', '_2')).drop('index', ax
final = final.drop(columns = ['count_1'])
final.rename(columns = {'count_2': 'count'}, inplace=True)
#view the top 5 commmunication pairs
print(final.head(5))
```

```
             IP_1             IP_2  count
0  137.132.228.15     193.62.192.8   4951
1    130.14.250.11   103.37.198.100   2842
2    14.139.196.58  192.101.107.153   2368
```

```
3    103.21.126.2    140.112.8.139   2056
4    167.205.52.8    140.90.101.61   1752
```

Visualizing these communication pairs (By IP Address)

There are two parts to this:

1. Visualising based on the IP address of the sending and receiving hosts
2. Based on the location where these IP addresses are originating from

In [9]:
```
commpair = final.head(500)
```

In [10]:
```
import sys
!{sys.executable} -m pip install pyvis
```

```
Requirement already satisfied: pyvis in c:\users\samik\anaconda3\lib\site-packages
(0.1.9)
Requirement already satisfied: networkx>=1.11 in c:\users\samik\anaconda3\lib\site-p
ackages (from pyvis) (2.5)
Requirement already satisfied: jsonpickle>=1.4.1 in c:\users\samik\anaconda3\lib\sit
e-packages (from pyvis) (2.1.0)
Requirement already satisfied: ipython>=5.3.0 in c:\users\samik\anaconda3\lib\site-p
ackages (from pyvis) (7.19.0)
Requirement already satisfied: jinja2>=2.9.6 in c:\users\samik\anaconda3\lib\site-pa
ckages (from pyvis) (2.11.2)
Requirement already satisfied: decorator>=4.3.0 in c:\users\samik\anaconda3\lib\site
-packages (from networkx>=1.11->pyvis) (4.4.2)
Requirement already satisfied: prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0 in c:\us
ers\samik\anaconda3\lib\site-packages (from ipython>=5.3.0->pyvis) (3.0.8)
Requirement already satisfied: pygments in c:\users\samik\anaconda3\lib\site-package
s (from ipython>=5.3.0->pyvis) (2.7.2)
Requirement already satisfied: colorama; sys_platform == "win32" in c:\users\samik\a
naconda3\lib\site-packages (from ipython>=5.3.0->pyvis) (0.4.4)
Requirement already satisfied: backcall in c:\users\samik\anaconda3\lib\site-package
s (from ipython>=5.3.0->pyvis) (0.2.0)
Requirement already satisfied: pickleshare in c:\users\samik\anaconda3\lib\site-pack
ages (from ipython>=5.3.0->pyvis) (0.7.5)
Requirement already satisfied: jedi>=0.10 in c:\users\samik\anaconda3\lib\site-packa
ges (from ipython>=5.3.0->pyvis) (0.17.1)
Requirement already satisfied: traitlets>=4.2 in c:\users\samik\anaconda3\lib\site-p
ackages (from ipython>=5.3.0->pyvis) (5.0.5)
Requirement already satisfied: setuptools>=18.5 in c:\users\samik\anaconda3\lib\site
-packages (from ipython>=5.3.0->pyvis) (50.3.1.post20201107)
Requirement already satisfied: MarkupSafe>=0.23 in c:\users\samik\anaconda3\lib\site
-packages (from jinja2>=2.9.6->pyvis) (1.1.1)
Requirement already satisfied: wcwidth in c:\users\samik\anaconda3\lib\site-packages
(from prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0->ipython>=5.3.0->pyvis) (0.2.5)
Requirement already satisfied: parso<0.8.0,>=0.7.0 in c:\users\samik\anaconda3\lib\s
ite-packages (from jedi>=0.10->ipython>=5.3.0->pyvis) (0.7.0)
Requirement already satisfied: ipython-genutils in c:\users\samik\anaconda3\lib\site
-packages (from traitlets>=4.2->ipython>=5.3.0->pyvis) (0.2.0)
```

In [11]:
```
from pyvis.network import Network
```

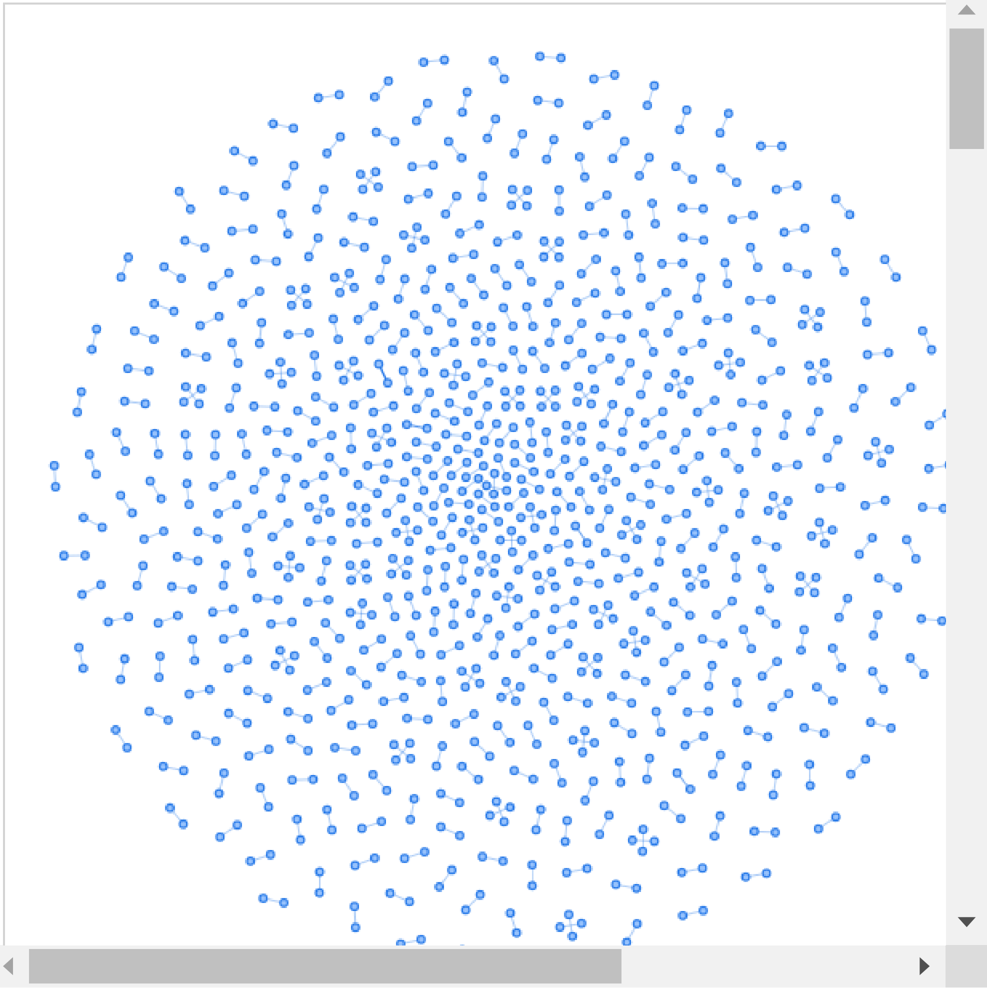
In [12]:
```
commgraph = Network(notebook = True)
#firstly must have a unique list of ip hosts
iphost = pd.DataFrame(commpair[['IP_1']])
iphost2 = pd.DataFrame(commpair[['IP_2']])
iphost.rename(columns = {'IP_1': 'IP'}, inplace = True)
iphost2.rename(columns = {'IP_2': 'IP'}, inplace = True)
finaltable = pd.concat([iphost, iphost2])
finaltable = finaltable.drop_duplicates('IP').reset_index(drop=True)
#print(finaltable)
for i in finaltable.index:
    commgraph.add_node(str(finaltable.loc[i, "IP"]))
```

```
#commgraph.show('nodes.html')
```

In [13]:
```
# the list of edges is stored in commpair
for i in commpair.index:
    commgraph.add_edge(str(commpair.loc[i, "IP_1"]), str(commpair.loc[i, "IP_2"]), v

commgraph.show_buttons(filter_=True)
commgraph.show('nodes.html')
```

Out[13]:



Visualizing these communication pairs (By Location)

There are two parts to this:

1. Visualising based on the IP address of the sending and receiving hosts
2. Based on the location where these IP addresses are originating from

In [14]:
```
!{sys.executable} -m pip install IP2Location
import os
import IP2Location

ip = '137.132.228.15'

database = IP2Location.IP2Location(os.path.join("IP-COUNTRY.BIN"))

rec = database.get_all(ip)
print(rec.country_long)
print(rec.country_short)
```

```
Requirement already satisfied: IP2Location in c:\users\samik\anaconda3\lib\site-pack
ages (8.7.2)
```

```
Singapore
SG
```

In [15]:
```
locgraph = Network(notebook = True)
for i in finaltable.index:
    rec = database.get_all(str(finaltable.loc[i, "IP"]))
    if (rec.country_long != 'INVALID IP ADDRESS' and rec.country_long != 'IPV6 ADDRE
        locgraph.add_node(str(rec.country_long))
```

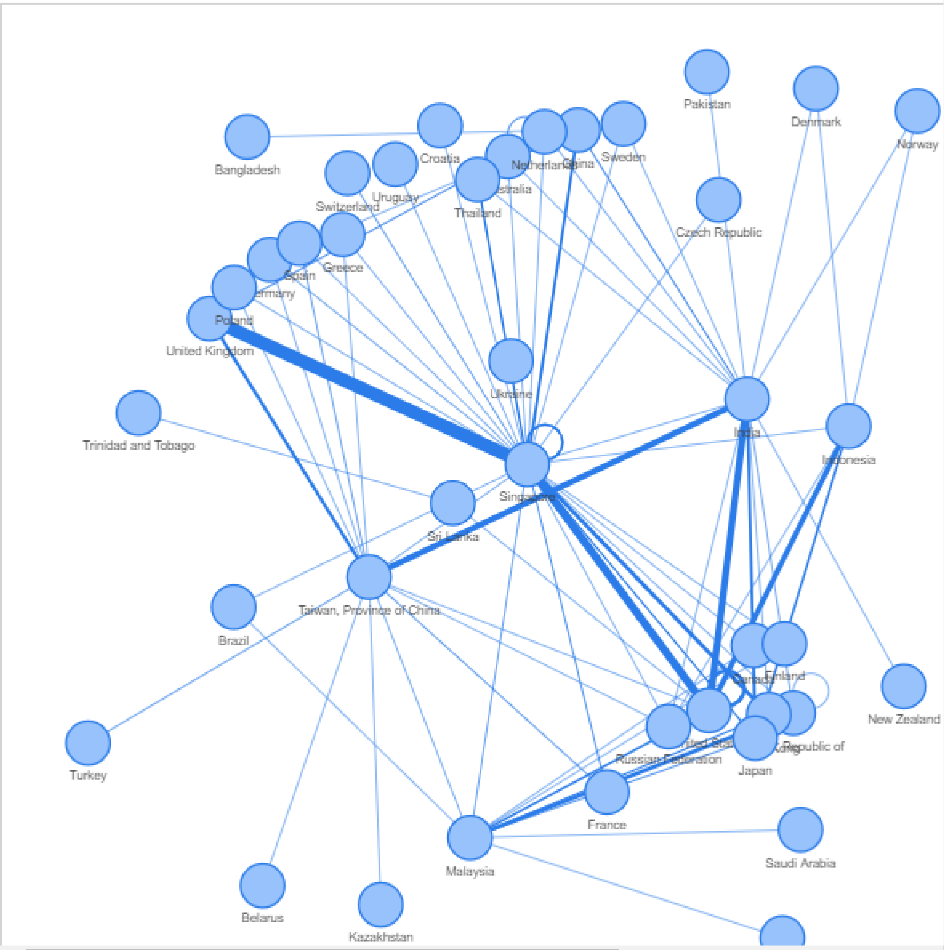
In [16]:
```
# the list of edges is stored in commpair

for i in commpair.index:
    rec1 = database.get_all(str(commpair.loc[i, "IP_1"]))
    city1 = str(rec1.country_long)
    rec2 = database.get_all(str(commpair.loc[i, "IP_2"]))
    city2 = str(rec2.country_long)

    if (city1 != 'INVALID IP ADDRESS' and city1 != 'IPV6 ADDRESS MISSING IN IPV4 BIN
        if (city2 != 'INVALID IP ADDRESS' and city2 != 'IPV6 ADDRESS MISSING IN IPV4
            #print(city1, city2)
            locgraph.add_edge(city1, city2, value = int(commpair.loc[i, "count"]))


locgraph.repulsion(node_distance=70, spring_length=250)
locgraph.show_buttons(filter_=True)
locgraph.show('locgraph.html')
```

Out[16]:



In [ ]: